Geometry

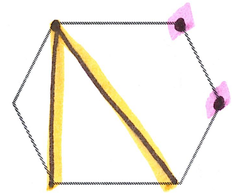
Ms. Linzmeier

Unit 8: Quadrilaterals

Priority Standard: Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

Unit 8 "I can" Statements:

1. I can find the interior and exterior angle measures of polygons.
2. I can apply the properties of parallelograms to find unknown angle and side measures.
3. I can apply the properties of parallelograms to identify parallelograms.
4. I can apply the properties of rhombuses, rectangles and squares to classify special parallelograms as rhombuses, rectangles and squares
5. I can apply the properties of rhombuses, rectangles and squares to find unknown angle and side measures.
6. I can apply the properties of trapezoids and kites to classify special quadrilaterals as trapezoids and kites
7. I can apply the properties of trapezoids and kites to find unknown angle and side measures.
8. I can use the properties from the unit to identify and classify quadrilaterals as parallelograms, rhombuses, rectangles, squares, trapezoids and/or kites.

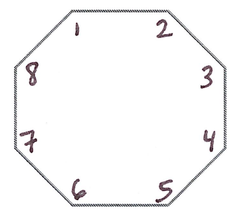


Consecutive Vertices: two vertices that are endpoints of the same side

Diagonal: a segment that joins two nonconsecutive vertices

Polygon Interior Angles Theorem (Theorem 8.1):

The sum of the measures of the interior angles of a convex n-gon is $(n-2)180$ ($n=$ # of sides)



Example: $n=8$

$(8-2)180 \rightarrow 6(180) = 1080°$

Interior Angles of a Quadrilateral (Corollary to Theorem 8.1):

The sum of the measures of the interior angles of a quadrilateral is $360°$

Example #1: Find the sum of measures of the interior angles of a convex hexagon.

$n=6$ $(6-2)180$

$4(180) = 720°$

Example #2: The sum of the measures of the interior angles of a convex polygon is 1260°. Classify the polygon by the number of sides.

$$\frac{1260°}{180} = \frac{(n-2)\cancel{180}}{\cancel{180}}$$

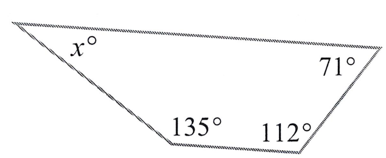
$7 = n-2$

$+2 \quad +2$

$9 = n$

$\boxed{\text{nonagon}}$

Example #3: Find the value of x in the diagram shown.



$n=4 \rightarrow 360°$

$x + 71 + 135 + 112 = 360$

$x + 318 = 360$

$-318 \quad -318$

$x = 42°$

$\boxed{x = 42°}$

Example #4: Find the sum of the measures of the interior angles of the convex decagon.

$n = 10$ $\quad (10-2)180$

$1440°$

Example #5: Use the diagram at the right. Find $m\angle K$ and $m\angle L$.

$n = 5$ $\quad (5-2)180$

$540° = \text{total}$

$68 + 105 + 109 + x + x = 540$

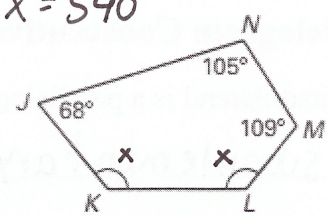
$\cancel{282} + 2x = 540$

$-282 \qquad -282$

$\frac{2x}{2} = \frac{258}{2}$

$x = 129°$

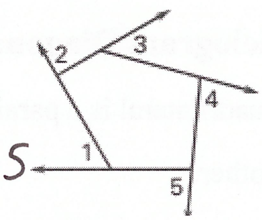
$\boxed{\angle K = 129°, \angle L = 129°}$



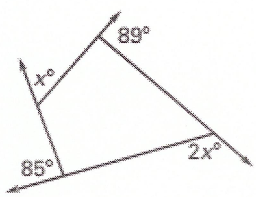
Polygon Exterior Angles Theorem (**Theorem 8.2**):

The sum of the measures of the exterior angles of a convex polygon, one angles at each vertex, is $\underline{360°}$.

$360° = m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 + m\angle 5$



Example #6: Find the value of *x* in the diagram shown.



$89 + 85 + x + 2x = 360°$

$\cancel{174} + 3x = 360$

$-\cancel{174} \qquad -174$

$\frac{3x}{3} = \frac{186}{3}$

$\boxed{x = 62°}$

Example #7: The base of a lamp is in the shape of a regular 15-gon.

a.) Find the measure of each interior angle.

$n = 15$ $\quad (15-2)180$

regular $\frac{\text{total}}{\text{\# of sides}}$ $\quad \frac{2340}{15} = \boxed{156°}$

b.) Find the measure of each exterior angle.

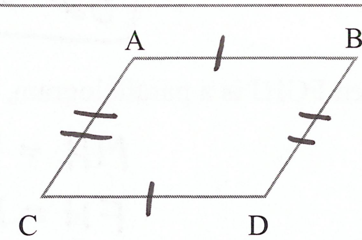
$\frac{360°}{15} = 24°$

Chapter 8.2: Use Properties of Parallelograms

Parallelogram: A quadrilateral with both pairs of opposite sides parallel
(definition)

Parallelogram Congruent Side Theorem (**Theorem 8.3**):

If a quadrilateral is a parallelogram, then its opposite sides are congruent



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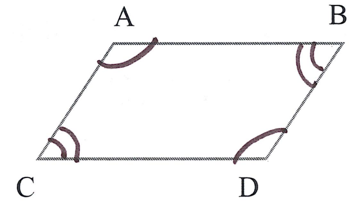
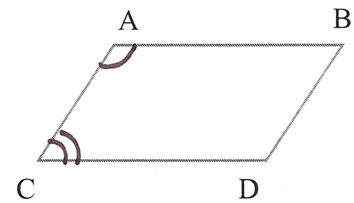


Parallelogram Consecutive Angle Theorem (Theorem 8.5):

If a quadrilateral is a parallelogram, then its consecutive angles are supplementary

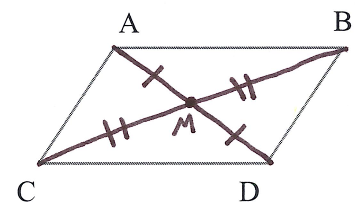
$m\angle A + m\angle C = 180°$

$m\angle A + m\angle B = 180°$ etc...

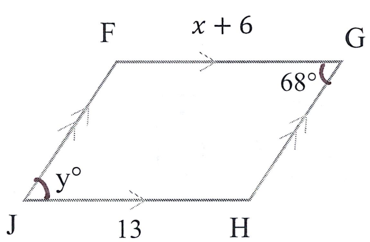


Parallelogram Diagonal Bisect Theorem (Theorem 8.6):

If a quadrilateral is a parallelogram, then its diagonals bisect each other.



Example #1: Find the values of x and y.



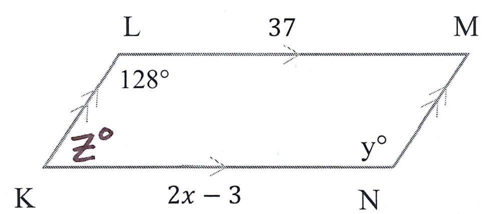
$y = 68°$

$x + 6 = 13$

$-6 \quad -6$

$\boxed{x = 7}$

Example #2: Find the indicated measure in parallelogram KLMN.



Find x

$2x - 3 = 37$

$+3 \quad +3$

$\frac{2x}{2} = \frac{40}{2}$

$\boxed{x = 20}$

Find y

$y = 128°$

Find z

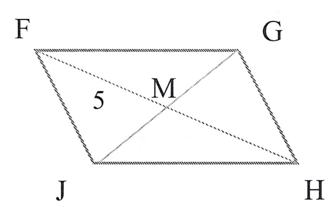
$180 - 128° = z$

$\boxed{52° = z}$

Given FGHJ is a parallelogram, find MH and FH.

$MH = 5$

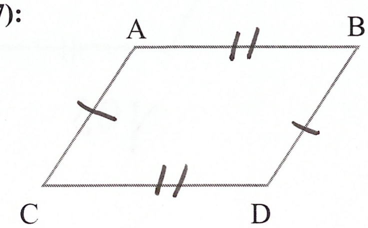
$FH = 10$



Chapter 8.3: Use Properties of Parallelograms

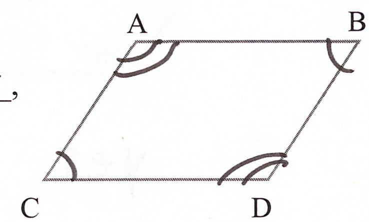
Parallelogram with Congruent Sides Converse Theorem (Theorem 8.7):
(Converse of Theorem 8.3)

If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.



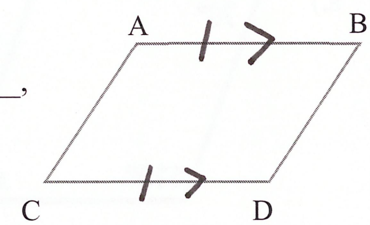
Parallelogram with Congruent Angles Converse Theorem (Theorem 8.8):
(Converse of Theorem 8.4)

If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram.



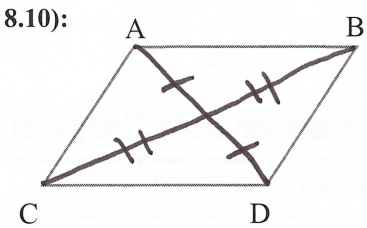
Quadrilateral with a Congruent and Parallel Side (Theorem 8.9):

If one pair of opposite sides of a quadrilateral are congruent, and parallel, then the quadrilateral is a parallelogram.



Parallelogram with Bisecting Diagonal Converse Theorem (Theorem 8.10):
(Converse of Theorem 8.6)

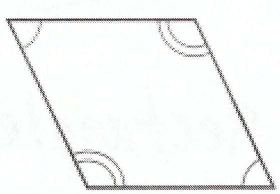
If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram



Example #1: Decide whether you are given enough information to determine that the quadrilateral is a parallelogram. Explain your reasoning.

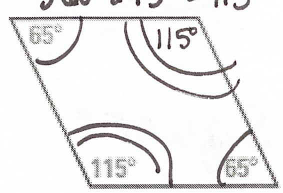
115+65+65
360-245 = 115

a.)



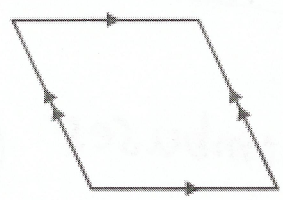
yes
thm 8.8

b.)



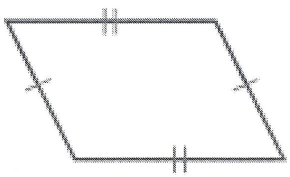
yes

c.)



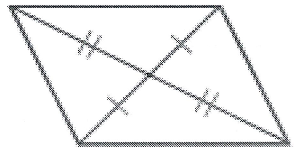
No

d.)



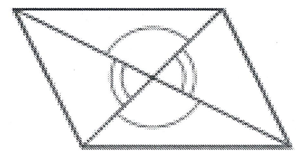
yes

e.)



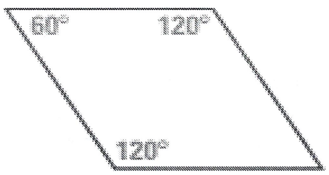
yes

f.)



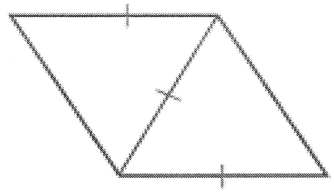
NO

g.)



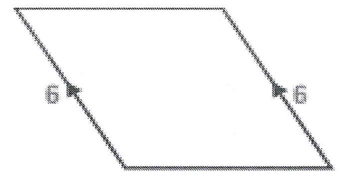
yes

h.)



NO

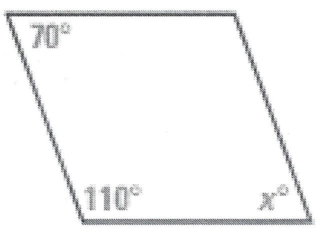
i.)



yes

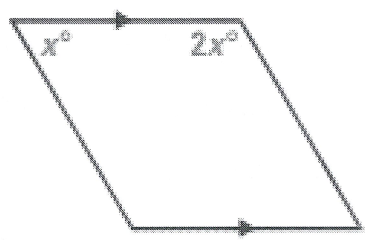
Example #2: What value of *x* will make the polygon a parallelogram?

a.)



70°

b.)

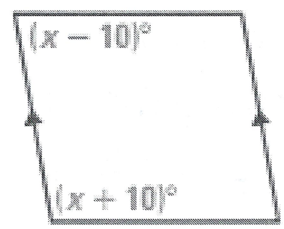


$x + 2x = 180$

$\frac{3x}{3} = \frac{180}{3}$

$\boxed{x = 60}$

c.)



$x - 10 + x + 10 = 180$

$\frac{2x}{2} = \frac{180}{2}$

$\boxed{x = 90°}$

Chapter 8.4: Properties of Rhombuses, Rectangles and Squares

Section Summary:

Parallelograms

- All int ∠'s add up to 360°
- diagonals bisect each other
- consecutive int ∠'s are supplementary (180)
- 2 pairs of parallel sides
- opp. ∠'s are ≅
- opp sides are ≅